

AN INTERTIDAL MOSS MITE IN AMERICA

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It was in 1896 (1, p. 77) that this species was first reported (as *Northus* (?) *marinus*) from intertidal rocks at Sea Cliff, Long Island, N. Y. as not uncommon. In 1919 (April 13th) I found numerous specimens on intertidal stones of Hempstead Harbor at Mosquito Cove (between Sea Cliff and Glen Cove), and (May 18th) at Eltingville Beach, Staten Island, New York harbor on rocks submerged at mid-tide and covered with fine algae. In 1926 I found none at Cold Spring Harbor, Centerport, or Stonybrook (Long Island) but (July 4th) a few at Indian Harbor, Greenwich, Connecticut, though not east of that point. I have searched for intertidal oribatids at Bridgeport, New Haven, Conn.; Boston harbor; Cliff Island, Casco Bay, Me.; Vancouver and Victoria, B. C.; and on the coast of Shantung, China, and of northern Japan, without finding any. None are reported from Woods Hole (2).

From these records and my experience, it is evident that this species is distinctly marine though mostly restricted to estuaries and harbors, *i.e.* where there is not too much sand scour, and thus where growths of films of unicellular algae may develop. It would therefore not be expected on the exposed headlands between the bays where algal coated rocks are rare or absent. I also suspect that it would be rare or absent where rocks are without crannies and fissures. The rougher the rock (as schist) the better.

Another factor limiting the spread of the species is that of viviparity. This means that there are no eggs for dissemination by water currents, but that the young are born on the parental stone.

After a careful study of this American material, I find it to be closely related to the species now known in Europe as *Ameronothrus spoofi*, which was first reported from spawn of

Lymnaea in subsaline water, and on subsaline algae, near Abo, Finland, under the name *Scutovertex spoofi* (3). Its author later (4, 5) thought this species to be identical with a described English species (6). The two have since been clearly differentiated by Halbert (7) who records his Irish material from "moist limestone flakes on the rocky shore at Malahide in the Orange Lichen and Pelvetia zones, and somewhat doubtfully in the *Spiralis* zone. In these habitats they were in small colonies round the outer edges of the flakes; . . . also under stones resting on sandy mud at the mouth of a small stream flowing into Malahide estuary. At Mulranny it occurred under stones on the seashore. May to Sept."

Three species occur on the English and North Sea coast with a third as holarctic (*A. lineatus*, the genotype). Thus the genus is Eurasian and the one species found about New York harbor must have been introduced, probably on ship ballast (usually estuarine or harbor rocks) during the sailing-ship days.

Since Banks found it at Glen Cove in 1896, and it had not reached Cold Spring harbor by 1926 it must be a slow migrant. It may be inferred therefore that it was introduced into New York harbor at a very early period to reach Glen Cove by 1896, especially when one bears in mind its viviparous habits. A consideration of its tarsal armature, spine studded body, and strongly developed instinct to snuggle into crannies, lead me to doubt if individuals are carried by currents. Furthermore I know of no records of finding them in tow nets.

As this species, *A. spoofi*, *A. bilineatus* (6) and *A. schneideri* (8) differ from the other species of the group by a striking loss, namely that of pseudostigmata and its organ, and show as well other indications of development in advance of the other species, as: less wrinkling of the notogaster (it being highly wrinkled in the immature stages), ventral plate well developed so that notogaster does not encroach on its postero-lateral angles, its distinctly aquatic habits; I propose segregating them in another genus which may be known as:

Hygroribates, gen. nov.

Char.: Wingless oribatid mites with notogaster and cephaloprothorax fused and not dorsally demarked, and further united by the character of the

longitudinal sculpturing; anal and genital apertures well separated; leg segments distinctly pedicellate; ventral plate well developed so that notogaster does not encroach on it at postero-lateral corners; pseudostigmata not developed.

Type: *Northus* (?) *marinus* Banks 1896

In this connection it should be noted that these four species, representatives of a moss inhabiting group, have reached "the sea" by way of estuaries and protected bays and harbors, and that the subject of this paper is the furthest from "home," and has developed three hooks to the ungues, areae porosae, and less marked notogastral wrinkling, all greater departures from the immature and primitive condition. The spines are relatively shorter than in some of the related species. It is therefore, a climax species in habitat and in some morphological characters.

In order to supplement the extremely meager description, and render future identification certain and easy, I append a detailed description and figures.

***Hygroribates marinus* (Banks) comb. nov.**

Color blackish; size averaging 0.85 mm. in length of body.

Cephaloprothorax as seen from above (figure 3, upper half): broadly triangular; acetabulae I forming conspicuous bosses at posterior angles; completely anchylosed to abdomen and without demarkation; as seen from side (figures 1 and 2): high, angled at distal end of lamellae; rostrum, seen from above: somewhat mammelonate, *i.e.* impressed at insertions of rostral bristles, separated from frons by a distinct depression or constriction; lamellae developed as a slight ridge running from lamellar bristles postero-laterad to terminate dorsad of acetabulae II (figure 3); one or two cross-ridges may occur posteriad to lamellar bristles ("translamellar ridges"); tectopodia entirely undeveloped; bristles (as most body bristles) short, stout, pointed, slightly curved; interlamellar bristles lacking; acetabulae I and II developed as prominent, projecting bosses; pseudostigmata (and organs) entirely lacking, sometimes represented by a bristle (figures 1 and 3); anterior edge of abdomen produced onto cephaloprothorax as low ridges which fray out in various ways, and enclose between them and the lamellar ridges an elongated depression which shows up conspicuously as a pale strip (over acetabulae II) by indirect illumination; vertex with U-shaped ridge similar to that of figure 3, enclosing a slender pair of diverging ridges. This ridge is not exactly the same in all individuals but the base of the U is generally heavier than the arms.

Notogaster sculptured with small, more or less hexagonal areolae (indicated in figure 1); lower rim with muscle strands showing through as dark

bands along ventro-lateral portion (figures 1 and 9, the latter showing areolae as seen from side); faint, short ridges developed as indicated in figure 3. These ridges are indeterminate and vary in extent and position in each individual; there are usually two or three transverse ridges posterior to base of the cephaloprothoracic U; bristles short, stout, pointed, arranged in two rows: I: 1-6 and II: 1-7, plus humeral; I: 1 usually on anterior rim of anteriormost transverse ridge; I: 4 most approximate, except possibly the always obliquely set, converging I: 6; II: 1 close behind anterior edge of notogaster; II: 2 far posteriad, *i.e.* II: 1 and II: 2 are the most widely spaced bristles except possibly I: 4 and I: 5; II: 4 and II: 5 very close together as also I: 5 and I: 6; II: 7 very short, oblique and set in a depression so that it is visible only under special conditions. One individual has two II: 1 (and no bristle at *Pseudostigmata situs*)! A large (sometimes double—figure 1) area porosa (?) on each side on transverse plane between bristles II: 3 and II: 4 but more ventrad; this area porosa looks more like a hole in the chitin with two opposite fingers of chitin more or less dividing the aperture; a diagonally set fissura ventro-posteriad of the areae porosae; two or three fine punctures near ventral rim of notogaster both anterior to and posterior to areae porosae.

Ventral plate (figure 3) not encroached upon by notogaster; posterior edge angularly produced (figure 2) more or less provided with chitin folds, the commoner condition illustrated in figure 3; surface otherwise smooth; anal aperture broadly pyriform, with only a blunt postero-lateral angle; covers each with usually two, sometimes three! bristles close to median edge and within central third; median pair of postanal bristles inserted close to center of cover; lateral pair of postanal bristles inserted at sides of aperture just posteriad to transverse plane of posterior cover bristles; preanal bristles inserted far down on sides of aperture, on transverse plane of anterior cover bristles!; a short fissura at each side of aperture, anterior to preanal bristles; paramesial bristles inserted less than diameter of a genital cover postero-laterad of genital aperture; genital aperture pentagonal, posterior angle fairly square, anterior edge short; each cover with six bristles, all directed backward except the long first (figure 2), spaced as in figures 2 and 3; tectopodia not developed unless the acetabular bulge of legs II is interpreted as a tectopedium but note that the outer chitin does not extend anterior to the acetabulum itself; apodemata rather short, apodemata II the longest, with well developed median process directed posteriad; parasterna III with a rather long bristle inserted near base of leg, directed laterad and thus usually visible from above (as in the Oribatinae); parasterna II also with a "tectopedial bristle"; other parasternal bristles inserted as in figure 3; there appear to be bristle insertions *above* insertions of legs I, II and III! as indicated in figure 1; tectopodia bristles II and III are shown in figure 2 as well as the bristles above insertion of legs I; labial bristles near distal margin; chitin parts of insertion of legs I are indicated by broken lines in figure 2.

Legs fairly long (longer than in the Nothrinae) segments rather cylindrical, though they show a great enough degree of shaping (see figures 4, 6, 8)

to regard them as Brachypylina. Certainly the tibiae are constricted at the proximal end; so are the femora (figure 8) while the genuals are very much shorter. All femora with areolar sculpturing (figure 8). Bristles chiefly shorter than diameter of segments, stout, pointed, usually straight. Tarsi highly specialized for grappling and clinging. Ungues triheterohamate, the outer hooks very distinct, somewhat angular, wide spread. Legs I (figure 4) with distal end of femora reaching beyond tip of rostrum (figures 1 and 3); tarsi (figure 4) much shorter than tibiae, dorsal edge subparallel to ventral, distal end of dorsal edge sharply descending to apex, proximal bristle on either side short, inserted greatest diameter of segment from proximal end, fairly close to dorsal edge; these are preceded on median face by a fairly long bristle inserted near dorsal edge and near dorsal angle; a subequally long, curved bristle (major bristle) with hooked tip, inserted on the angle; another bristle resembling the long bristle of median face inserted on dorsal edge just distad of angle. These three form a brush at the dorsal angle (angle brush); another brush (distal) composed of two pairs of long, fine, distally hooked bristles inserted along the dorso-distal slope; ventral edge with a stout spine inserted on median face on transverse plane of dorsal angle, twice as long and stout as a quite short one inserted on the lateral side, but distad of transverse plane of the short bristles near dorsal edge; apex with a fairly long, stout spine (apical spine) slightly curved toward the hooks, a pair of medium long, fine bristles inserted dorso-proximad of the spine; curving about base of unguis and evidently part of it are a pair of strongly curved, compressed spines (sickle spines) which are drawn out into a fine curved point, this curve describing a semicircle and extending half way across curve of the hook (only those of lateral face are presented in figure 4). Tibiae stoutest distad of center, massively pedicellate; dorsal face with two, fairly long bristles inserted close together at distal end of segment, the distal-most the longer, bent toward the tarsus, nearly as long as tarsus, the proximal one curved slightly backward; a spine inserted diameter of segment from distal end of segment; ventral face with a spine inserted near distal end; middle portion of segment with three spines, two on lateral face and one on median face, none on same transverse plane. There seems to be a minute bristle inserted at base of dorso-distal. Genuals stoutly pedicellate; with a whorl of four spines, that of median face very short, that of lateral face fairly long. Femora with well formed, angular pedicel (figure 3), a low carina along dorsal edge (figure 3); dorsal face with a spine inserted laterad of the carina on distal third of body of segment; a lateral spine inserted diameter of segment from distal end; a small median spine inserted slightly more distad than lateral spine; a ventral spine inserted as far from proximal end of body of segment as lateral spine is inserted from distal end. Coxae small, bristleless.

Legs II quite similar but tarsi (figure 5) shorter, lacking small lateral and median bristles; dorsal edge with a *pair* of fairly long bristles bent in opposite directions, inserted shortly proximad of dorsal angle; a longer, distally hooked (major) bristle inserted on angle, with a shorter one at its foot, the

angle brush thus formed of four bristles; distal brush formed of two pairs, inserted about center of oblique dorsal edge; the two spines of ventral face subequal, inserted just proximad of transverse plane of dorsal angle; other bristles quite similar. Tibiæ shorter; the pair of dorsal face bristles inserted diameter of segment from distal end; a spine inserted shortly proximad of dorsal pair; a lateral spine inserted closely distad of transverse plane of dorsal pair; two ventral spines, the distal inserted less than its length from distal end, the proximal inserted at center of segment. If there are others they are very indistinct. Genuals as genuals I. Femora only slightly shorter; dorsal spine inserted at center of body of segment; ventral spine inserted at proximal fourth, lateral and median spines inserted almost opposite each other, shortly distad of transverse plane of dorsal, thus the relative positions of these three spines are the same but they are all inserted much further proximad.

Legs IV (figures 1 and 7, and compare also with the very similar figure 9) more slender; tarsi with a long (major) bristle (equal to length of tarsus) inserted on distal end of dorsal face, just proximad of angle, the only representative of the angle brush; distal brush includes the usual two pairs of long, fine, distally hooked bristles; ventral edge with usual two, heavy spines inserted: the median one on transverse plane of major bristle the lateral just proximad thereof; curved distal (sickle) spine shorter and stouter than in tarsus I; the pair of shorter, fine, curved bristles similar but inserted on each side of insertion dorsad of distal spine, that is on same transverse plane; curved ungual spine with three teeth along its outer (convex) edge, making it serrate; what in tarsus I is hooked, terminal bristle of the sickle spine is here a distinct bristle inserted at center of base of ungual hook, the sickle spine having a fine point; another hooked bristle not represented in leg I is inserted on dorsal edge of unguis, its hook extending half way across curve of ungual hook. Tibiæ (figures 1 and 7) almost parallel sided, tapering but very little at proximal end; with two dorsal bristles inserted close together less than diameter of segment from its distal end, the distal one being short, the proximal being fairly long and curved proximad; a lateral spine inserted greatest diameter of segment from its proximal end; two ventral spines, the distal inserted on transverse plane of short dorsal, the proximal inserted as far proximad of lateral bristle as ventro-distal is from lateral. Genuals quite short, only slightly constricted at proximal end, armed with two spines, a lateral and a shorter dorso-mesal. Femora obtusely fusiform with very short but strongly constricted pedicel; a dorsal spine inserted near center; a ventro-lateral spine inserted slightly distad of transverse plane of dorsal. Coxæ (figure 1) elongate, semipyriform, distal end drawn out into a crest applied close to abdomen (figure 3); but one (dorso-ventral) spine.

Legs III very similar but shorter; tarsi (figures 1, 9, 10) shorter, with an additional, medium long, distally directed bristle inserted just proximad of dorsal (major) which is as long as that of tarsus IV; ventro-proximal spine inserted more distant from its neighbor. Tibiæ with dorsal pair of bristles

inserted a distance greater than width (height) of segment from proximal end, other bristles practically the same. Genuals similar. Femora with addition of a ventral spine inserted on transverse plane of dorsal. Coxae shorter; with two spines, the additional one inserted near center of lateral face.

Thus this species resembles *H. spoofi* in having trihetero-hamate ungues, areae porosae, and similar areolations but very weakly developed to evanescent on top and front. The notogastral wrinklins resemble those of *H. bilineatus* but are more broken (*H. spoofi* and *H. schneideri* have no wrinkles). *H. schneideri* has interspaces between areolae as broad as the areolae while in *H. spoofi* and *H. marinus* they are much finer and resemble the meshes of a net.

H. spoofi differs from *H. marinus* in that:

1. the lamellar bristles are broadly included by the ridges;
2. the transverse ridge posterior to base of the U-ridge is very heavy and sometimes merges with the base of the U so that:
3. the notogaster bristles I:1 seem to be inserted on base of the U;
4. notogaster bristles II:4-6 are more distantly spaced;
5. notogaster bristles I:5 and 6 are not oblique, and almost on the same longitudinal plane, I:6 appearing much longer (in dorsal view) than I:5;
6. the notogaster is without ridges (in the three types kindly sent me by Dr. A. C. Oudemans for study);
7. sternal bristles 2 and 3 are in line with bristles of parasterna III;
8. the genital aperture has a broad frame thus shoving sternal bristles 3 out laterally;
9. the paramesial bristles are more distant from genital aperture;
10. the postanal bristles 2 and the preanal bristles are more anteriorly inserted;
11. the postanal bristles 2 are opposite the bulge of the anal aperture;
12. the anal covers have only two pairs of bristles;

13. the mesal bristles of femora I and II are inserted near center of body of segment, while the disto-lateral bristles are also much more distant from distal end of segment.

One specimen from Zeeburg seems identical but is badly mashed down and flattened out.

The question which arises is, from where was *H. marinus* introduced. It may well be that the records from Ireland are this species and not *H. spoofi*.

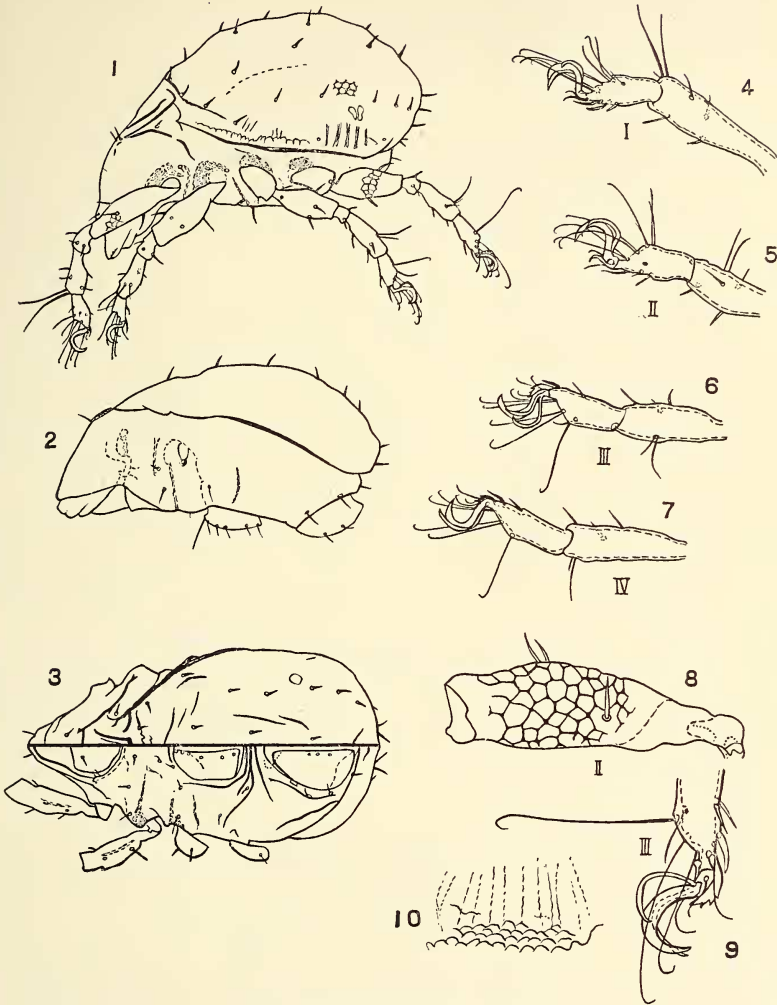
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PLATE XX

Hygroribates marinus (Banks) 1896

- Fig. 1. Lateral view, seen somewhat from above; sculpturing only indicated; ratio 60.
- Fig. 2. Lateral view, seen slightly from below; legs omitted to show ventral covers; ratio 60.
- Fig. 3. Dorso-ventral view; legs and sculpturing omitted; ratio 60.
- Fig. 4. Tarsus and tibia I, lateral view; ratio 120.
- Fig. 5. Tarsus and tibia II, lateral view; ratio 120.
- Fig. 6. Tarsus and tibia III, lateral view; ratio 120.
- Fig. 7. Tarsus and tibia IV, lateral view; ratio 120.
- Fig. 8. Femur II, ventro-lateral aspect; ratio 200.
- Fig. 9. Tarsus III, lateral aspect, bristles of median side omitted; ratio 200.
- Fig. 10. Sculpturing and muscle strands of side of abdomen; ratio 200.



HYGORIBATES MARINUS